

Claims

- [c1] A vehicle comprising a drivetrain, having an internal combustion engine (1) and a gearbox (9) coupled to the internal combustion engine, and a control unit (45) for automatic gear selection as a function of the current rotational speed of an input shaft to the gearbox (9), in which the control unit (45) has a first operating mode (56) with a first working speed range (81) defined by a first lower limit (68) for downshifting to a gear with a higher transmission ratio, wherein the control unit (45) has a second operating mode (57) with a second working speed range (70) defined by a second lower limit (69) for downshifting to a gear with a higher transmission ratio, in which the second limit (69) is lower than the idling speed (80) of the internal combustion engine and is equal to a lower rotational speed than the first lower limit (68).
- [c2] The vehicle as recited in claim 1, wherein the control unit (45) comprises a memory unit (72) in which a representation (74) of the highest permitted gear in the second working speed range (70) is stored.
- [c3] The vehicle as recited in claim 1 or 2, wherein the control unit (45) is configured to select the highest permitted gear or a gear lower than the highest permitted gear when the control unit has assumed the second operating mode (57).
- [c4] The vehicle as recited in any of claims 1-3, wherein the control unit is coupled to elements (54) for indicating the selection of first or second operating mode.
- [c5] The vehicle as recited in any of claims 1-3, wherein the vehicle contains an engine management unit (53), which comprises an idling speed regulator (75), the idling speed regulator (75) being designed to control the torque delivered from the internal combustion engine (1) when the vehicle is operated at idling speed in the second operating mode (57).

- [c6] The vehicle as recited in any of claims 1-3, wherein the representation (74) of the highest permitted gear comprises a representation (74) defining the highest permitted gear when driving at idling speed as a function of the current weight of the vehicle and the current gradient of the road on which the vehicle is being driven.
- [c7] The vehicle as recited in claim 6, wherein the control unit (45) contains a representation (73) defining the highest permitted starting gear as a function of the current weight of the vehicle and the current gradient of the road on which the vehicle is being driven, and that the representation (74) defining the highest permitted gear when driving at idling speed is based on the representation defining the highest permitted starting gear.
- [c8] The vehicle as recited in claim 7, wherein the representation (74) defining the highest permitted gear at idling speed consists of the representation defining the highest permitted starting gear (73) plus a predetermined number of gear shift stages.
- [c9] The vehicle as recited in any of claims 1-3, wherein the vehicle contains elements (45, 3) for establishing that the internal combustion engine is delivering sufficient torque for operation of the vehicle at an operating speed equal to a rotational speed of a gearbox input shaft below the first limit (68).
- [c10] The vehicle as recited in claim 9, wherein the drivetrain contains a clutch unit (3) arranged between the internal combustion engine and the gearbox, the drivetrain being divided into a first part (51) up to the clutch unit and comprising the internal combustion engine (1) and a second part from the clutch unit (3) onwards and comprising the gearbox (9), characterized in that the second limit (69) for downshifting is equal to a speed lower than the idling speed (80) of the internal

combustion engine, that the vehicle contains a sensor for measuring the current rotational speed (60), and that the sensor (60) is designed to measure the rotational speed in the second part (52) of the drivetrain, the clutch unit (3) being designed to absorb a speed differential between the rotational speed of the first and second parts (51 152) of the drivetrain where insufficient torque has been delivered by the internal combustion engine (1), following which a rotational speed equal to the second downshifting limit is reached and downshifting is permitted.

- [c11] The vehicle as recited in claim 9, wherein the control unit (45) is designed to establish that the internal combustion engine (1) is delivering sufficient torque by performing a comparison between an estimate of the torque delivered by the internal combustion engine (1) in the current operating state and the torque demanded from the internal combustion engine (1) for operation of the vehicle in the current operating state.
- [c12] The vehicle as recited in any of claims 1-3, wherein the elements (54) for indicating selection of the first or second operating mode comprise a throttle lever (54) forming part of the vehicle, the control unit being designed to assume its second operating mode (57) should the throttle lever (54) be released into an idling position whilst in motion.
- [c13] A method for automatic gear selection in a gearbox (9) forming part of a vehicle as a function of the current rotational speed of a shaft forming part of the gearbox comprising the following steps: establishing of a first operating mode (56) of a control unit (45), in which the first operating mode (56) comprises a first working speed range (81) with a first lower limit for downshifting to a gear with a higher transmission ratio; establishing a second operating mode (57) of the control unit (45) in which the second operating mode (57) comprises a second

working speed range (70) with a second lower limit (69) for downshifting to a gear having a higher transmission ratio, where the second lower limit (69) is lower than the idling speed (80) of the internal combustion engine (1); establishing of a representation (74) of the highest permitted gear in the second working speed range of the control unit; selection of either the first or second operating mode (56, 57) of the control unit (45); generation of a downshift signal to a gearbox on passing the first limit (68), should the control unit have assumed its first operating mode (56); driving of the vehicle in the highest permitted gear in the second speed range (70); and generation of a downshift signal to a gearbox on passing the second limit (69), should the control unit have assumed its second operating mode (57).

- [c14] The method as recited in claim 13, wherein a management unit (53) assigned to the internal combustion engine comprises an idling speed regulator (75), the idling speed regulator (75) controlling the torque delivered by the internal combustion engine when the vehicle is operated at idling speed in the second operating mode.
- [c15] The method as recited in claims 13 or 14, wherein the highest permitted gear is selected from the representation (74) of the highest permitted gear as a function of the current weight of the vehicle and the current gradient of the road on which the vehicle is being driven.
- [c16] The method as recited in claims 13 or 14, wherein the control unit (45) contains a representation (74) defining the highest permitted starting gear as a function of the current weight of the vehicle and the current gradient of the road on which the vehicle is being driven, and that the selection of the highest permitted gear is undertaken from the representation (73) defining the highest permitted starting gear plus a predetermined number of shift stages.

- [c17] The method as recited in claims 13 or 14, wherein downshifting from the highest permitted gear at idling speed is undertaken following the occurrence of slip in a clutch unit (3) forming part of the vehicle drivetrain, the slip occurring as a result of the fact that the torque required to drive the vehicle in the current operating situation is greater than a predetermined torque level of the idling speed regulator (75) of the internal combustion engine.
- [c18] The method as recited in claims 13 or 14, wherein the control unit assumes its second operating mode (57) in that a throttle lever (54) forming part of the vehicle is released during operation of the vehicle.